
DOE/OR/21548-275
CONTRACT NO. DE-AC05-86OR21548

QUARTERLY ENVIRONMENTAL DATA SUMMARY—FOURTH QUARTER 1991

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

MARCH 1992


REV. 0



U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

Printed in the United States of America. Available from the National Technical Information Service, NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161

NTIS Price Codes - Printed copy: A05
Microfiche: A01

 MK-FERGUSON <small>A MORRISON KNUDSEN COMPANY</small>	Issue Date:
	Rev. No. 0
PLAN TITLE: Quarterly Environmental Data Summary - Fourth Quarter 1991	

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Weldon Spring Site Remedial Action Project

Quarterly Environmental Data Summary Fourth Quarter 1991

Revision 0

March 1992

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U.S. DEPARTMENT OF ENERGY
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Under Contract DE-AC05-86OR21548

ABSTRACT AND WELDON SPRING SITE QUARTERLY SELF ASSESSMENT FOURTH QUARTER 1991

The purpose of this Quarterly Environmental Data Summary is to provide to the public preliminary data acquired as part of the Weldon Spring Site Remedial Action Project (WSSRAP) environmental monitoring program. The document summarizes the preliminary environmental data, highlights any potentially significant findings, and offers tentative interpretations. Validated data and final interpretations will appear in the 1991 Annual Site Environmental Report.

This report includes preliminary data from environmental monitoring activities at the Weldon Spring site (WSS) during the fourth quarter of 1991. Groundwater, surface water, and air were sampled in order to monitor potential exposure pathways. Analytical parameters included radionuclides, nitroaromatic compounds, inorganic anions, and direct gamma exposure. The results are used to calculate exposure doses (where applicable) and assess the impact of the contaminants at the site on potentially exposed populations.

In summary, no significant differences were observed in off-site exposures during the fourth quarter of 1991 relative to exposures calculated in previous quarters. Contaminated groundwater did not affect the St. Charles County well field. Surface water containing elevated uranium activity continued to impact the Femme Osage Slough. Off-site gamma results are not available at this time; however, off-site radon, and air particulate exposures remained indistinguishable from background. Off-site monitoring demonstrated that exposure levels at the Francis Howell High School, the Busch Wildlife Area Headquarters, and the Weldon Spring Training Area remain indistinguishable from background levels.

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1 INTRODUCTION

This document is the seventh in a series of documents designed to provide a summary of the findings from the routine environmental monitoring programs at the Weldon Spring Site Remedial Action Project (WSSRAP). These documents supplement the *Annual Site Environmental Report* (ASER) by providing interested outside agencies and organizations with more frequent access to WSSRAP data. They provide data resulting from routine environmental sampling as described in the *WSSRAP Environmental Monitoring Plan* (EMP) (MKF and JEG 1991) and a brief interpretation of that data.

It is the goal of this document to summarize and briefly discuss the data, highlighting data that differ significantly from observations made in previous reports. The full interpretation of these data (as well as data in other quarterly summaries) will be undertaken in the 1991 ASER. It is recommended that interested readers refer to previous EMPs, ASERs, and project documents for more information on existing site conditions, site history, transport mechanisms, and quantified contaminant levels. The monitoring scheme for every calendar year is established prior to that year in the annual EMP. Each sampling location to be monitored during the upcoming year is identified in the EMP and the schedule of analytical parameters is tabulated for easy reference. These reports may be obtained by visiting the WSSRAP reading room or contacting the WSSRAP Community Relations Manager at 314-441-8086.

These quarterly reports are intended to include data from all quarterly environmental monitoring programs conducted at the WSSRAP including groundwater, surface water, National Pollutant Discharge Elimination System (NPDES), radon gas, gamma radiation, and air particulates (including asbestos and radioactive particulates). However, because of delays in data delivery from the analytical laboratories, some of the data that was expected to be included in this report are not yet available for reporting. The unavailability of data is due to a nationwide shortage in analytical services. These data will be reported in the 1991 ASER. Sludges, soils, and biological specimens are not sampled on a routine basis; therefore, analytical results for these parameters are not included in this report. Trend analyses are being prepared from historical data for surface water, groundwater and air pathways. These analyses will be presented in the 1991 ASER. Quality control (QC) data for the fourth quarter and all other quarters will be presented in the 1991 ASER.

2 GROUNDWATER MONITORING

The groundwater is sampled regularly at both the Weldon Spring Chemical Plant/raffinate pits/vicinity properties (WSCP/RP/VP) and the Weldon Spring Quarry (WSQ). Due to differences in the environmental settings and sources of contaminants, separate monitoring schedules are followed. Therefore, results of groundwater monitoring at the WSCP/RP/VP and WSQ will be discussed separately.

2.1 Chemical Plant/Raffinate Pits/Vicinity Properties

The groundwater at the chemical plant/raffinate pits/vicinity properties area is monitored on a semi-annual basis with the exception of MW-2001, MW-2002, MW-2003, MW-3003, MW-3006, MW-3008, MW-3009, MW-3023, MW-4012, and MW-4013 which are monitored quarterly for uranium, nitrate, sulfate, and metals. Monitoring well locations are shown in Figure 2-1.

2.1.1 Nitroaromatic Results

Table 2-1 contains nitroaromatic data from samples collected from the semiannually monitored groundwater wells at the WSCP/RP/VP area. Nitroaromatic compounds were detected in seven samples for which data are currently available. Concentration levels for these compounds are within their historical range.

2.1.2 Radiological Results

The radiological results for samples from quarterly monitored wells at the WSCP/RP/VP are presented in Table 2-2. The upper bound for natural uranium background concentration in groundwater at the WSCP/RP/VP has been determined to be 3.4 pCi/l (MKF and JEG 1989). The U.S. Environmental Protection Agency (EPA) has not yet established a drinking water standard for uranium; however, the proposed maximum contaminant level (MCL) currently set at 20 $\mu\text{g/l}$ which is equal to 12 pCi/l using site specific conversion factors. The U.S. Department of Energy (DOE) has a health-based, derived concentration guideline (DCG) of 600 pCi/l in surface water effluent.

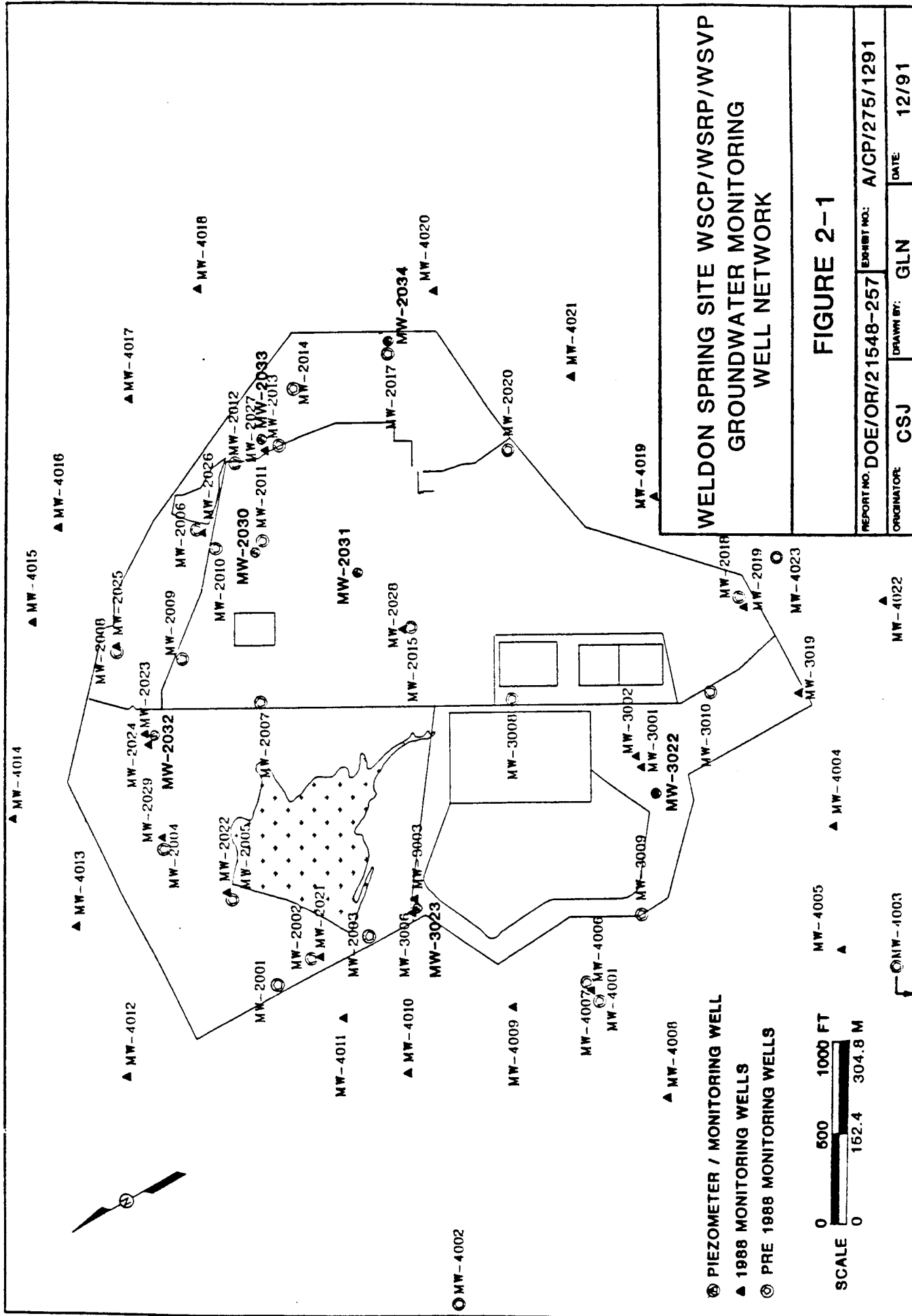


TABLE 2-1 Semi-Annual Nitroaromatic Data for Groundwater at the WSCP/RP/VP

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-2001-111491	NR	NR	NR	NR	NR	NR
GW-2002-111491	NR	NR	NR	NR	NR	NR
GW-2003-Q491	NR	NR	NR	NR	NR	NR
GW-2004-111891	ND	ND	ND	ND	ND	ND
GW-2006-110591	ND	ND	0.13	2.40	ND	12.0
GW-2013-110591	ND	0.13	0.31	19.0	0.88	6.20
GW-2015-111291	ND	ND	ND	ND	ND	ND
GW-2018-111291	ND	ND	ND	ND	ND	ND
GW-2020-103191	ND	ND	ND	ND	ND	ND
GW-2023-110691	ND	ND	ND	ND	ND	ND
GW-2028-102991	ND	ND	ND	ND	ND	ND
GW-2029-102491	ND	ND	ND	ND	ND	ND
GW-2030-111891	ND	ND	0.20	30.0	8.00	3.10
GW-2031 Abandoned in 1991						
GW-2032-111891	ND	ND	0.094	3.50	5.60	3.10
GW-2033-111891	ND	ND	0.23	2.80	0.80	2.60
GW-2034-111891	ND	ND	ND	ND	ND	ND
GW-3001-102491	NA	NA	NA	NA	NA	NA
GW-3003-Q491	NR	NR	NR	NR	NR	NR
GW-3006-110691	ND	ND	ND	ND	ND	ND
GW-3008-Q491	NR	NR	NR	NR	NR	NR
GW-3009-Q491	NR	NR	NR	NR	NR	NR
GW-3010 Abandoned in 1991						
GW-3022 Abandoned in 1991						
GW-3023-Q491	NR	NR	NR	NR	NR	NR
GW-4012-Q491	NR	NR	NR	NR	NR	NR
GW-4013-Q491	NR	NR	NR	NR	NR	NR
GW-4015-120291	ND	ND	0.070	1.00	ND	0.56
GW-4016-120391	ND	ND	ND	ND	ND	ND

TABLE 2-1 Semi-Annual Nitroaromatic Data for Groundwater at the WSCP/RP/VP
(Continued)

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-4017-120491	ND	ND	ND	ND	ND	ND
GW-4020-120391	ND	ND	ND	ND	ND	ND
GW-4022-102391	NA	NA	NA	NA	NA	NA
GW-4023-102191	ND	ND	0.059	0.045	ND	0.13

NA - Not Available
ND - Not Detected
NR - Not Required 4th quarter

TABLE 2-2 Fourth Quarter and Semiannual Uranium and Inorganic Anion Data in Groundwater at the WSCP/RP/VP

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-2001-111491	22.5	7.70	NA
GW-2002-111491	501	105	NA
GW-2003-Q491	380	135	NA
GW-2004-111891	0.89	2.00	0.750
GW-2006-110591	6.50	33.8	ND
GW-2013-110591	0.57	17.7	ND
GW-2015-111291	ND	93.9	0.810
GW-2018-111291	0.22	9.60	1.15
GW-2020-103191	0.38	142	4.93
GW-2023-110691	ND	17.7	2.74
GW-2028-102991	ND	126	2.34
GW-2029-102491	ND	19.4	1.99
GW-2030-111891	1.40	43.6	0.894
GW-2031	Abandoned in 1991		
GW-2032-111891	76.7	49.2	0.577
GW-2033-111891	0.93	21.6	1.18
GW-2034-111891	0.64	674	14.7
GW-3001-102491	874	20.5	1.90
GW-3003-Q491	354	164	NA
GW-3006-110691	ND	21.9	1.41
GW-3008-Q491	760	74.2	NA
GW-3009-Q491	98.7	72.7	NA
GW-3010	Abandoned in 1991		
GW-3022	Abandoned in 1991		
GW-3023-Q491	347	370	NA
GW-4012-Q491	0.32	48.1	NA
GW-4013-Q491	182	47.0	NA
GW-4015-120291	1.80	14.5	2.88
GW-4016-120391	ND	14.6	3.29

TABLE 2-2 Fourth Quarter and Semiannual Uranium and Inorganic Anion Data in Groundwater at the WSCP/RP/VP (Continued)

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-4017-120491	0.49	6.70	ND
GW-4020-120391	ND	125	15.3
GW-4022-102391	0.25	49.9	2.71
GW-4023-102191	4.90	75.5	1.18

ND - Not Detected
NA - Not Available

The highest uranium level detected from the available data was 15.3 pCi/l from a sample obtained from monitoring well MW-4020. The concentrations reported in Table 2-2 continue to indicate levels below the proposed drinking water standard for uranium.

2.1.3 Sulfate and Nitrate Results

Sulfate and nitrate concentrations are given in Table 2-2. The fourth quarter results are similar to historical ranges for these parameters.

2.1.4 Geochemical Results: Metals and Inorganic Anions

Geochemical parameters were added to the *Environmental Monitoring Plan* for the 1991 monitoring year. Results of analyses for samples from quarterly monitored wells at the WSCP/RP/VP are presented in Table 2-3. Concentrations from most geochemical constituents are similar to their previously measured levels; however, nickel and bromide concentrations display a notable drop to NDs from previously measurable levels. These changes in nickel and bromide are thought to reflect an analytical discrepancy and are currently being investigated.

2.2 Weldon Spring Quarry

Chemical and radiological wastes at the quarry are of particular concern because of their proximity to the St. Charles County well field. The well field is located approximately 0.8 km (0.5 mi) to the south of the Weldon Spring Quarry. Monitoring of contaminants in groundwater and the protection of the well field is a top priority at the Weldon Spring Site Remedial Action Project (WSSRAP).

Groundwater is currently being monitored in 48 wells in and around the quarry. Thirty-six monitoring wells installed by the DOE currently exist in or near the quarry. Four monitoring wells were installed by St. Charles County in 1986 and are currently included in the DOE's monitoring program. Eight St. Charles County municipal wells are also included in the DOE's monitoring program. All monitoring well locations are shown in Figures 2-2 and 2-3. These wells draw water from both bedrock and alluvial aquifers.

TABLE 2-3 Fourth Quarter Geochemical Results for Groundwater at the WSCP/RP/VP

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)	CALCIUM ($\mu\text{g/l}$)	CHROMIUM ($\mu\text{g/l}$)	IRON ($\mu\text{g/l}$)	LITHIUM ($\mu\text{g/l}$)	MAGNESIUM ($\mu\text{g/l}$)	MANGANESE ($\mu\text{g/l}$)	NICKEL ($\mu\text{g/l}$)
GW-2001-111491	ND	ND	87100	ND	72.3	ND	40600	ND	ND
GW-2002-111491	ND	24.7	290000	ND	ND	453	96300	ND	ND
GW-2003-Q491	ND	153	263000	ND	85.5	503	92300	3.29	ND
GW-3003-Q491	ND	150	253000	ND	ND	501	143000	17.9	ND
GW-3006-110691	ND	152	62400	ND	169	ND	50100	158	ND
GW-3008-Q491	ND	292	662000	ND	ND	255	175000	ND	ND
GW-3009-Q491	ND	1090	112000	ND	59.8	ND	62000	7.00	20.1
GW-3023-Q491	8.30	90.3	385000	32.4	8860	851	87400	176	ND
GW-4012-Q491	ND	30.0	17900	99.0	55.6	ND	31600	ND	ND
GW-4013-Q491	ND	147	146000	ND	ND	ND	52900	ND	ND

TABLE 2-3 Fourth Quarter Geochemical Results for Groundwater at the WSCP/RP/VP (Continued)

SAMPLE ID	POTASSIUM ($\mu\text{g/l}$)	SODIUM ($\mu\text{g/l}$)	STRONTIUM ($\mu\text{g/l}$)	NITRITE ($\mu\text{g/l}$)	BROMIDE ($\mu\text{g/l}$)	CHLORIDE ($\mu\text{g/l}$)	PHOSPHORUS TOTAL ($\mu\text{g/l}$)	SILICA, DISSOLVED ($\mu\text{g/l}$)	ALKALINITY (mg/l)
GW-2001-111491	1500	8080	87.7	ND	ND	5900	60	8590	320
GW-2002-111491	9670	113000	360	ND	ND	10200	80	11600	270
GW-2003-Q491	6870	117000	490	ND	ND	9690	60	11000	262
GW-3003-Q491	9520	162000	597	160	ND	13000	90	9090	280
GW-3006-110691	1260	17600	207	ND	ND	2100	600	10500	360
GW-3008-Q491	2000	244000	1750	ND	ND	24400	50	11500	230
GW-3009-Q491	869	25900	225	ND	ND	5000	ND	8200	170
GW-3023-Q491	5260	228000	664	1390	ND	16500	50	10600	270
GW-4012-Q491	71600	45500	63.0	ND	ND	3100	50	14300	300
GW-4013-Q491	7000	35100	154	ND	930	8190	110	11800	300

NA - Not Available

ND - Not Detected

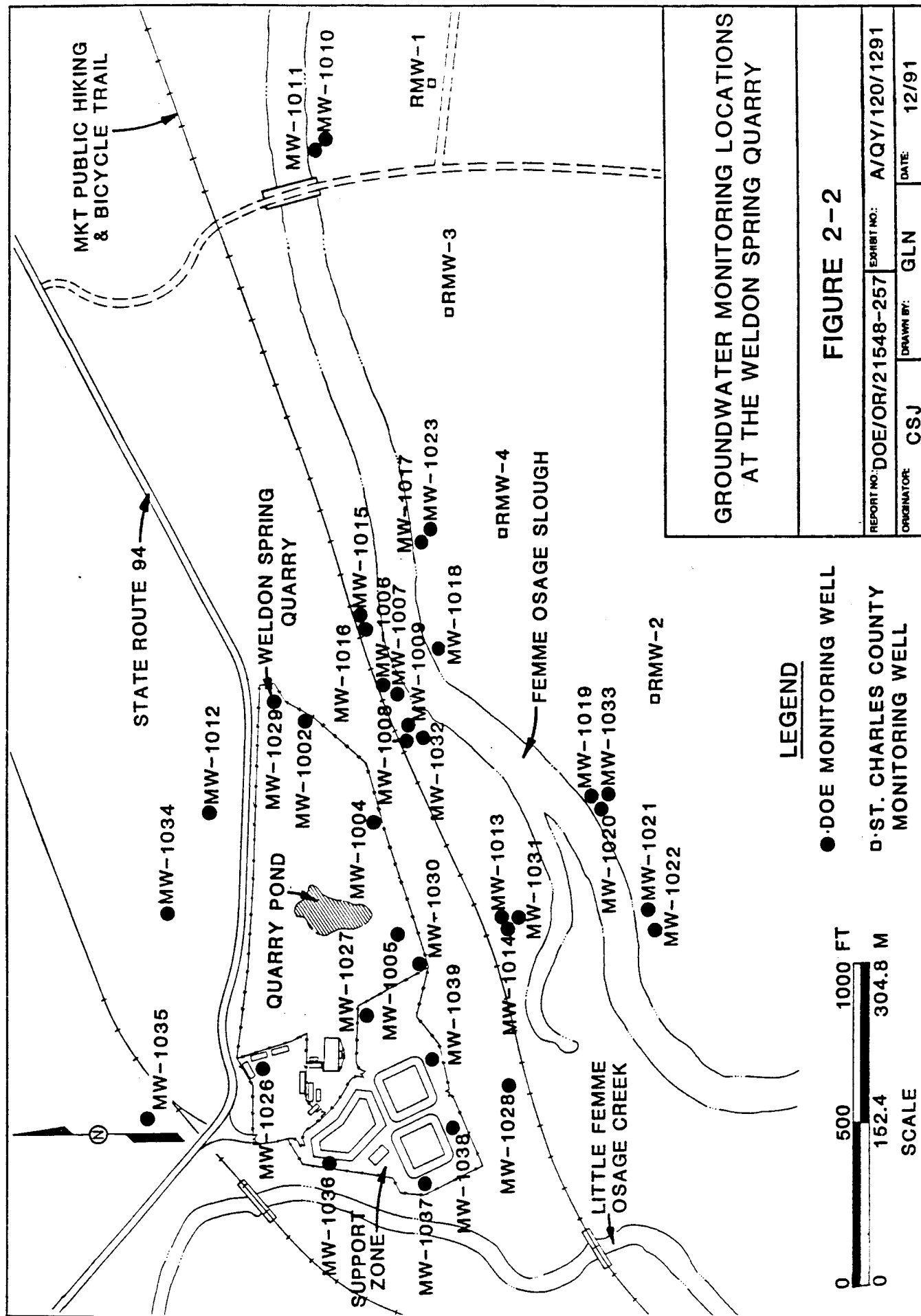
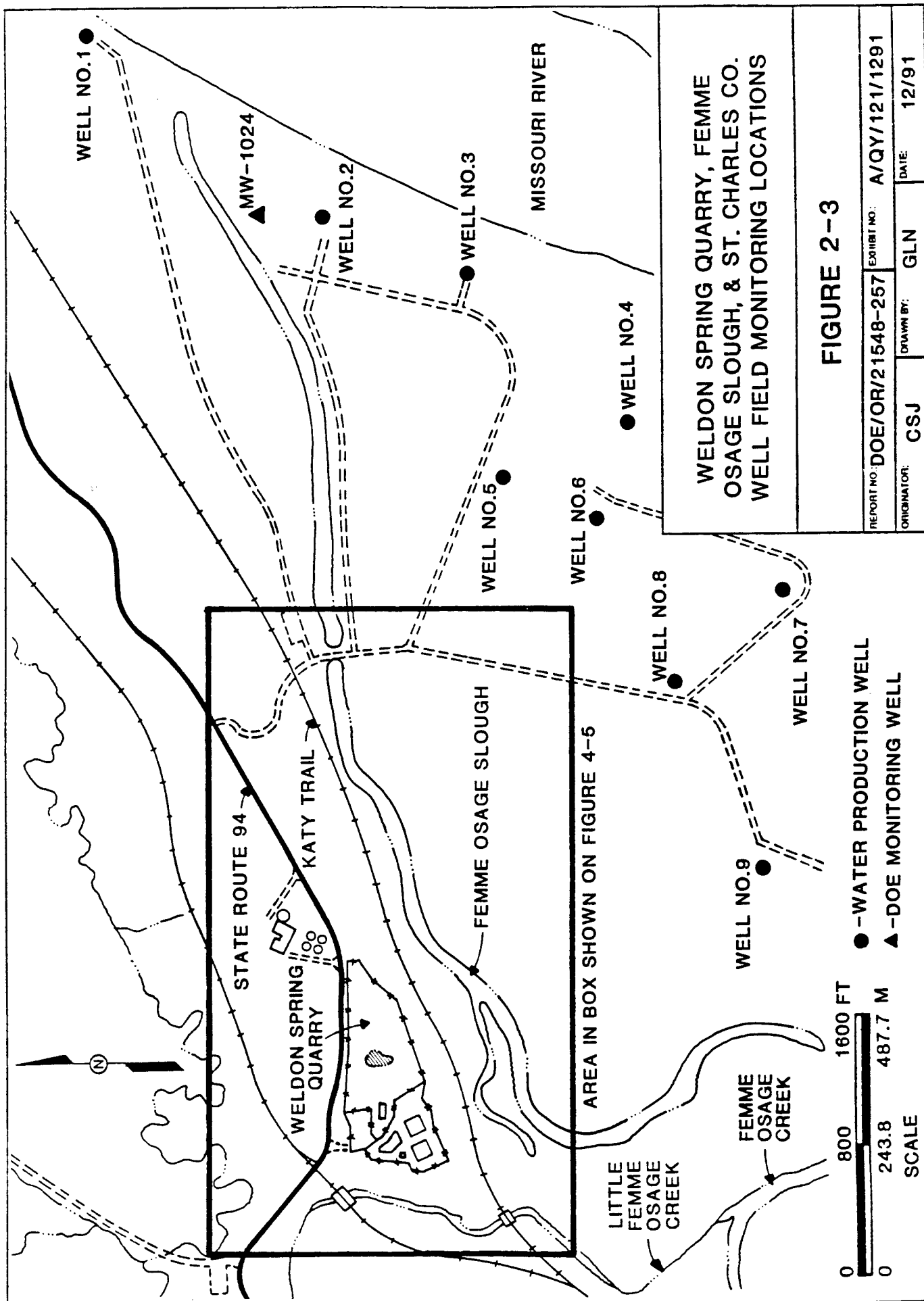


FIGURE 2-2

REPORT NO.: DOE/OR/21548-257	EXHIBIT NO.: A/QY/120/1291
ORIGINATOR: CSJ	DRAWN BY: GLN
	DATE: 12/91



Two separate groundwater monitoring programs have been developed for the quarry. The first program is a bimonthly sampling of all wells north of the Femme Osage Slough and MW-1010 and MW-1011. Also note that MW-1035, MW-1036, MW-1037, MW-1038, and MW-1039 will be sampled monthly until operation of the Weldon Spring Quarry water treatment plant is initiated. The second program is the quarterly sampling of all wells south of the Femme Osage Slough, excluding MW-1010 and MW-1011 but including the St. Charles County well field. Both the raw and treated waters from the St. Charles County water treatment plant are also sampled.

2.2.1 Radiological Results

Radiological data are presented in Tables 2-4, 2-5, and 2-6 for samples collected on a bimonthly and quarterly basis. The results show typical fluctuations near the average levels in the WSQ area with the exception of MW-1006. Uranium concentrations in this well were higher than recent values but did not exceed recent results for MW-1004 which appears to be hydrologically related.

2.2.2 Nitroaromatic Compounds Results

Analytical results for nitroaromatic compounds are presented in Tables 2-7, 2-8, and 2-9. No monitoring wells south of the Femme Osage Slough showed detectable concentrations of nitroaromatic compounds during the fourth quarter of 1991. The distribution and magnitude of nitroaromatic contamination near the quarry remains unchanged.

2.2.3 Inorganic Anions Results

Two inorganic anions--nitrate and sulfate--were measured in quarry wells. The analytical results for fifth and sixth bimonthly periods and the fourth quarter are presented in Tables 2-4, 2-5, and 2-6, respectively. These results are consistent with data reported in the previous environmental monitoring reports. The WSQ groundwater samples continue to indicate no significant nitrate contamination of the groundwater. The high nitrate value of 3020 mg/l in RMW3-Q491 is attributed to a sampling error. This sample appears to have been inadvertently preserved with nitric acid.

TABLE 2-4 Fifth Bimonthly (Sept/Oct) Inorganic Anions and Radiological Results in Groundwater at the Weldon Spring Quarry

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-1002-091291	0.79	49.5	4.61
GW-1004-091291	ND	230	2770
GW-1005-102291	ND	214	2260
GW-1006-101591	0.62	417	4730
GW-1007-101591	0.12	2.80	44
GW-1008-101591	Well Dry		
GW-1009-101591	0.10	349	ND
GW-1010-101691	0.13	ND	ND
GW-1011-101691	Well Dry		
GW-1012-110491 *	0.40	63.5	3.37
GW-1013-101691	0.14	114	926
GW-1014-101691	ND	108	623
GW-1015-101691	2.30	387	1510
GW-1016-101691	1.70	343	609
GW-1026-090591	ND	ND	ND
GW-1027-090591	0.21	118	1085
GW-1028-110491 *	ND	77.6	ND
GW-1029-102291	0.11	77.4	2.85
GW-1030-102291	ND	105	8.45
GW-1031-091191	ND	45.0	21.6
GW-1032-102191	ND	253	952
GW-1034-	Not accessible due to construction		
GW-1035-	Not accessible due to construction		
GW-1036-091091	0.26	58.8	2.88
GW-1036-102191	ND	57.4	3.95
GW-1037-091791	ND	20.3	1.15
GW-1037-100791	0.89	19.3	1.20
GW-1038-091791	ND	48.1	2.02

TABLE 2-4 Fifth Bimonthly (Sept/Oct) Inorganic Anions and Radiological Results in Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-1038-100791	ND	44.5	3.17
GW-1039-091791	0.45	60.8	3.17
GW-1039-100791	ND	73.1	1.44

ND - Not Detected

NA - Not Detected

NS - Not Sampled

* - Sampled after the fifth bimonthly period.

TABLE 2-5 Sixth Bimonthly (Nov/Dec) Inorganic Anions and Radiological Results in Groundwater at the Weldon Spring Quarry

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-1002-112591	1.30	569	3.14
GW-1004-112591	0.25	254	5040
GW-1005-112591	ND	207	2350
GW-1006-121691	1.89	399	4540
GW-1007-121691	0.16	209	155
GW-1008-121191	0.52	273	5330
GW-1009-121191	0.69	281	ND
GW-1010-121791	NR	NR	ND
GW-1011-121791	Well Dry		
GW-1012-121191	1.70	62.5	3.63
GW-1013-121191	0.37	115	923
GW-1014-121191	0.55	114	511
GW-1015-121691	3.79	294	1300
GW-1016-121791	1.89	242	602
GW-1026-111191	ND	0.64	ND
GW-1027-111191	0.11	83.0	1060
GW-1028-120491	0.14	87.5	1.38
GW-1029-112591	ND	731	2.65
GW-1030-112591	ND	1000	11.21
GW-1031-102191 *	ND	30.5	30.0
GW-1032-120491	ND	266	931
GW-1032-121191	0.54	255	949
GW-1034-110491	0.22	86.7	2.68
GW-1035-120591	0.19	41.9	1.01
GW-1036-111191	ND	54.1	4.38
GW-1036-120591	0.21	66.6	3.81
GW-1037-111191	ND	16.0	1.61
GW-1037-120591	ND	17.0	1.10

TABLE 2-5 Sixth Bimonthly (Nov/Dec) Inorganic Anions and Radiological Results in Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)
GW-1038-111191	ND	44.3	3.37
GW-1038-120591	ND	51.3	5.13
GW-1039-111191	ND	60.0	2.45
GW-1039-120591	ND	73.1	1.82

ND - Not Detected

NA - Not Detected

NS - Not Sampled

NR - Not Required fourth quarter

* - Sampled before the sixth bimonthly period.

TABLE 2-6 Fourth Quarter Inorganic Anions and Radiological Results for the Weldon Spring Quarry

SAMPLE ID	NITRATE (mg/l)	SULFATE (mg/l)	URANIUM (pCi/l)	GROSS ALPHA (pCi/l)
GW-1017-100991	ND	0.99	ND	NR
GW-1018-101791	ND	25.8	ND	NR
GW-1019-100791	ND	3.50	ND	NR
GW-1020-100791	ND	16.7	ND	NR
GW-1021-100891	ND	ND	0.577	NR
GW-1022-100891	ND	ND	0.577	NR
GW-1023-100991	ND	5.70	1.15	NR
GW-1024-101091	ND	ND	2.59	NS
GW-1033-101791	ND	19.2	1.64	NR
GW-RMW1-Q491	ND	279	1.44	NA
GW-RMW2-Q491	5.80	249	4.398	NA
GW-RMW3-Q491	3020 ⁺	34.2	ND	NA
GW-RMW4-Q491	4.20	340	NA	NA
GW-RAWW-Q491	NR	NR	ND	NA
GW-FINW-Q491	NR	NR	ND	NA
GW-PW02-Q491	NR	NR	ND	NA
GW-PW03-Q491	NR	NR	ND	NA
GW-PW04-Q491	NR	NR	ND	NA
GW-PW05-Q491	NR	NR	ND	NA
GW-PW06	Not on line			
GW-PW07-Q491	NR	NR	ND	NA
GW-PW08-Q491	NR	NR	ND	NA
GW-PW09-Q491	NR	NR	ND	NA

ND - Not Detected

NA - Not Available

NR - Not Required fourth quarter

+ - Data questionable, appears to be sampling error.

TABLE 2-7 Fifth Bimonthly (Sept/Oct) Nitroaromatic Data for Groundwater at the Weldon Spring Quarry

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-1002-091291	ND	0.13	0.042	7.00	19.0	140
GW-1004-091291	ND	ND	2.60	4.60	8.00	3.00
GW-1005-102291	ND	ND	0.14	0.050	ND	ND
GW-1006-101591	ND	ND	0.40	7.20	24.0	160
GW-1007-101591	ND	ND	ND	ND	ND	ND
GW-1008-101591	Well Dry					
GW-1009-101591	ND	ND	ND	ND	ND	ND
GW-1010-101691	ND	ND	ND	ND	ND	ND
GW-1011-101691	Well Dry					
GW-1012-110491 *	ND	ND	ND	ND	ND	ND
GW-1013-101691	ND	ND	0.11	0.035	ND	ND
GW-1014-101691	ND	ND	0.060	0.016	ND	ND
GW-1015-101691	ND	0.33	0.053	0.85	19.0	110
GW-1016-101691	ND	ND	ND	0.13	2.10	14.0
GW-1026-090591	ND	ND	ND	ND	ND	ND
GW-1027-090591	ND	ND	3.00	4.40	32.0	0.12
GW-1028-110491 *	ND	ND	ND	ND	ND	ND
GW-1029-102291	ND	ND	ND	ND	ND	ND
GW-1030-102291	ND	ND	0.054	ND	ND	ND
GW-1031-091191	ND	ND	ND	ND	ND	ND
GW-1032-102191	ND	ND	0.091	1.10	1.00	ND
GW-1034	Not accessible due to construction					
GW-1035	Not accessible due to construction					
GW-1036-102191	ND	ND	ND	ND	ND	ND
GW-1036-091091	ND	ND	ND	ND	ND	ND
GW-1037-091791	ND	ND	ND	ND	ND	ND
GW-1037-100791	ND	ND	ND	ND	ND	ND
GW-1038-091791	ND	ND	ND	ND	ND	ND

TABLE 2-7 Fifth Bimonthly (Sept/Oct) Nitroaromatic Data for Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-1038-100791	ND	ND	ND	ND	ND	ND
GW-1039-091791	ND	ND	ND	ND	ND	ND
GW-1039-100791	ND	ND	ND	ND	ND	ND

ND - Not Detected

NA - Not Available

* - Sampled after the fifth bimonthly period.

TABLE 2-8 Sixth Bimonthly (Nov/Dec) Nitroaromatic Data for Groundwater at the Weldon Spring Quarry

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-1002-112591	ND	0.19	0.093	28.0	60.0	250
GW-1004-112591	ND	ND	2.60	4.20	7.00	2.80
GW-1005-112591	ND	ND	0.11	0.046	ND	ND
GW-1006-121691	ND	ND	0.28	4.20	10.0	55.0
GW-1007-121691	ND	ND	ND	ND	ND	ND
GW-1008-121191	ND	ND	0.030	0.60	1.90	0.25
GW-1009-121191	ND	ND	ND	ND	ND	ND
GW-1010-121791	NR	NR	NR	NR	NR	NR
GW-1011-121791	NR	NR	NR	NR	NR	NR
GW-1012-121191	ND	ND	ND	ND	ND	ND
GW-1013-121191	ND	ND	0.12	0.042	ND	ND
GW-1014-121191	ND	ND	0.068	0.017	ND	ND
GW-1015-121691	ND	0.25	0.055	0.93	20.0	120
GW-1016-121791	ND	ND	ND	0.20	3.20	17.0
GW-1026-111191	ND	ND	ND	ND	ND	ND
GW-1027-111191	ND	ND	3.00	2.80	17.0	0.12
GW-1028-120491	ND	ND	ND	ND	ND	ND
GW-1029-112591	ND	ND	ND	ND	ND	ND
GW-1030-112591	ND	ND	0.047	ND	ND	ND
GW-1031-102191*	ND	ND	ND	ND	ND	ND
GW-1032-120491	ND	ND	0.13	0.48	0.15	ND
GW-1032-121191	ND	ND	0.48	0.67	2.10	0.080
GW-1034-110491	ND	ND	ND	ND	ND	ND
GW-1035-120591	ND	ND	ND	ND	ND	ND
GW-1036-111191	ND	ND	ND	ND	ND	ND
GW-1036-120591	ND	ND	ND	ND	ND	ND
GW-1037-111191	ND	ND	ND	ND	ND	ND
GW-1037-120591	ND	ND	ND	ND	ND	ND

TABLE 2-8 Sixth Bimonthly (Nov/Dec) Nitroaromatic Data for Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-1038-111191	ND	ND	ND	ND	ND	ND
GW-1038-120591	ND	ND	ND	ND	ND	ND
GW-1039-111191	ND	ND	ND	ND	ND	ND
GW-1039-120591	ND	ND	ND	ND	ND	ND

ND - Not Detected

NS - Not Sampled

NA - Not Available

NR - Not Required fourth quarter

* - Sampled before the sixth bimonthly period.

TABLE 2-9 Fourth Quarter Nitroaromatic Data for Groundwater at the Weldon Spring Quarry

SAMPLE ID	NB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	1,3,5-TNB ($\mu\text{g/l}$)
GW-1017-100991	ND	ND	ND	ND	ND	ND
GW-1018-101791	ND	ND	ND	ND	ND	ND
GW-1019-100791	ND	ND	ND	ND	ND	ND
GW-1020-100791	ND	ND	ND	ND	ND	ND
GW-1021-100891	ND	ND	ND	ND	ND	ND
GW-1022-100891	ND	ND	ND	ND	ND	ND
GW-1023-100991	ND	ND	ND	ND	ND	ND
GW-1024-101091	ND	ND	ND	ND	ND	ND
GW-1033-101791	ND	ND	ND	ND	ND	ND
GW-RMW1-Q491	ND	ND	ND	ND	ND	ND
GW-RMW2-Q491	ND	ND	ND	ND	ND	ND
GW-RMW3-Q491	ND	ND	ND	ND	ND	ND
GW-RMW4-Q491	ND	ND	ND	ND	ND	ND
GW-RAWW-Q491	ND	ND	ND	ND	ND	ND
GW-FINW-Q491	ND	ND	ND	ND	ND	ND
GW-PW02-Q491	ND	ND	ND	ND	ND	ND
GW-PW03-Q491	ND	ND	ND	ND	ND	ND
GW-PW04-Q491	ND	ND	ND	ND	ND	ND
GW-PW05-Q491	ND	ND	ND	ND	ND	ND
GW-PW06	Not on line					
GW-PW07-Q491	ND	ND	ND	ND	ND	ND
GW-PW08-Q491	ND	ND	ND	ND	ND	ND
GW-PW09-Q491	ND	ND	ND	ND	ND	ND

ND - Not Detected

NA - Not Available

NS - Not Sampled

2.2.4 Metals Results

A selected group of quarry wells located south of the Femme Osage Slough are sampled for arsenic and barium. Analytical results of these metals are given in Tables 2-10, 2-11 and 2-12. Results from the fifth and sixth bimonthly and fourth quarter analyses of arsenic and barium continue to indicate elevated concentrations in a few wells. The highest levels reported are 169 μ /l for arsenic and 1050 μ /l for barium, both from MW-1017. The high Ba value (5380 μ g/l) reported for GW-RMW3-Q391 in the third quarter Quarterly Environmental Data Summary (QEDS) was a typographical error and should be changed in 538 μ g/l.

TABLE 2-10 Fifth Bimonthly (Sept/Oct) Results for Metals in Groundwater at the Weldon Spring Quarry

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)
GW-1002-091291	ND	104
GW-1004-091291	ND	22.6
GW-1005-102291	ND	67.7
GW-1006-101591	ND	71.9
GW-1007-101591	26.3	566
GW-1008-101591	Well Dry	
GW-1009-101591	5.90	357
GW-1010-101691	107	367
GW-1011-101691	Well Dry	
GW-1012-110491 *	ND	126
GW-1013-101691	2.90	144
GW-1014-101691	ND	192
GW-1015-101691	ND	113
GW-1016-101691	ND	141
GW-1026-090591	19.6	386
GW-1027-090591	ND	110
GW-1028-110491 *	3.00	311
GW-1029-102291	ND	111
GW-1030-102291	5.10	370
GW-1031-091191	ND	76.6
GW-1032-102191	ND	122
GW-1034	Not accessible due to construction	
GW-1035	Not accessible due to construction	
GW-1036-091091	ND	263
GW-1036-102191	ND	303
GW-1037-091791	ND	495
GW-1037-100791	ND	556
GW-1038-091791	ND	234

TABLE 2-10 Fifth Bimonthly (Sept/Oct) Results for Metals in Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)
GW-1038-100791	ND	264
GW-3039-091791	ND	416
GW-1039-100791	ND	526

ND - Not Detected

NA - Not Available

* - Sampled after the fifth bimonthly period.

TABLE 2-11

Sixth Bimonthly (Nov/Dec) Results for Metals in Groundwater at the Weldon Spring Quarry

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)
GW-1002-112591	ND	122
GW-1004-112591	ND	37.2
GW-1005-112591	ND	61.7
GW-1006-121691	ND	51.0
GW-1007-121691	26.8	381
GW-1008-121191	ND	47.7
GW-1009-121191	8.80	390
GW-1010-121791	NR	NR
GW-1011-121791	NR	NR
GW-1012-121191	ND	130
GW-1013-121191	3.10	161
GW-1014-121191	ND	234
GW-1015-121691	ND	110
GW-1016-121791	ND	123
GW-1026-111191	22.4	420
GW-1027-111191	ND	104
GW-1028-120491	ND	334
GW-1029-112591	ND	109
GW-1030-112591	7.10	383
GW-1031-102191 *	ND	106
GW-1032-120491	ND	112
GW-1032-121191	ND	120
GW-1034-110491	ND	166
GW-1035-120591	ND	258
GW-1036-111191	ND	282
GW-1036-120591	ND	263
GW-1037-111191	ND	512
GW-1037-120591	ND	495

TABLE 2-11 Sixth Bimonthly (Nov/Dec) Results for Metals in Groundwater at the Weldon Spring Quarry (Continued)

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)
GW-1038-111191	ND	247
GW-1038-120591	ND	281
GW-1039-111191	ND	533
GW-1039-120591	ND	499

ND - Not Detected

NA - Not Available

NR - Not Required

* - Sampled before the sixth bimonthly period.

TABLE 2-12 **Fourth Quarter Results for Metals in Groundwater at the Weldon Spring Quarry**

SAMPLE ID	ARSENIC ($\mu\text{g/l}$)	BARIUM ($\mu\text{g/l}$)
GW-1017-100991	169	1050
GW-1018-101791	113	601
GW-1019-100791	70.8	688
GW-1020-100791	21.4	391
GW-1021-100891	79.6	863
GW-1022-100891	138	545
GW-1023-100991	75.6	381
GW-1024-101091	6.60	462
GW-1033-101791	ND	307
GW-RMW1-Q491	6.10	492
GW-RMW2-Q491	12.9	207
GW-RMW3-Q491	36.5	596
GW-RMW4-Q491	8.0	198
GW-RAWW-Q491	ND	389
GW-FINW-Q491	ND	98.30
GW-PW02-Q491	ND	351
GW-PW03-Q491	ND	286
GW-PW04-Q491	ND	295
GW-PW05-Q491	ND	368
GW-PW06	Not on line	
GW-PW07-Q491	ND	456
GW-PW08-Q491	ND	501
GW-PW09-Q491	3.00	514

ND - Not Detected

NA - Not Available

3 SURFACE WATER MONITORING

Routine samples were collected during the fourth quarter of 1991 from both on-site and off-site surface water and spring locations. All surface water samples were analyzed without filtering, unless a specific comparison of dissolved versus total contaminant concentrations was desired. Some analytical results are not available at this time; however, they will be presented in the 1991 Annual Site Environmental Report (ASER).

3.1 Chemical Plant/Raffinate Pits/Vicinity Properties

During the fourth quarter, surface water samples were collected from the 13 surface water sampling locations shown in Figure 3-1 and analyzed for uranium. The results, presented in Table 3-1, indicate that conditions remain similar to historical values.

3.2 Weldon Spring Quarry

Surface water samples were collected for uranium analyses from the 10 locations shown in Figure 3-2 and three locations in Figure 3-3. The results are presented in Table 3-2. Samples were collected from sampling locations SW-1003, SW-1004, SW-1005, SW-1007, SW-1009, and SW-1010 on a monthly basis to monitor slightly elevated uranium concentrations noted in the Quarterly Environmental Data Summary (QEDS) for the first and second quarters of 1991. Fourth quarter uranium concentrations for these locations are similar to lower pre-1991 values. The highest measured uranium concentration (1,950 pCi/l) was detected at the quarry pond (sampling location SW-1008) and is within the historical range for this site. Nitroaromatics, radionuclides, nitrate, and sulfate were measured for SW-1008 and are presented in Table 3-3. Concentrations of these constituents are similar to previously measured levels.

The fourth quarter uranium values measured for the Missouri River (SW-1011, SW-1012, and SW-1013) are similar to the third quarter values. In addition to the quarterly Missouri River samples, filtered and unfiltered samples (indicated by FI and NF in Table 3-2) were analyzed to evaluate the source of historical fluctuations in uranium concentrations at these locations as described in the Third Quarter QEDS. The fourth quarter data display little variation, either among the filtered and unfiltered samples from a single locale, or among samples from the three locales.

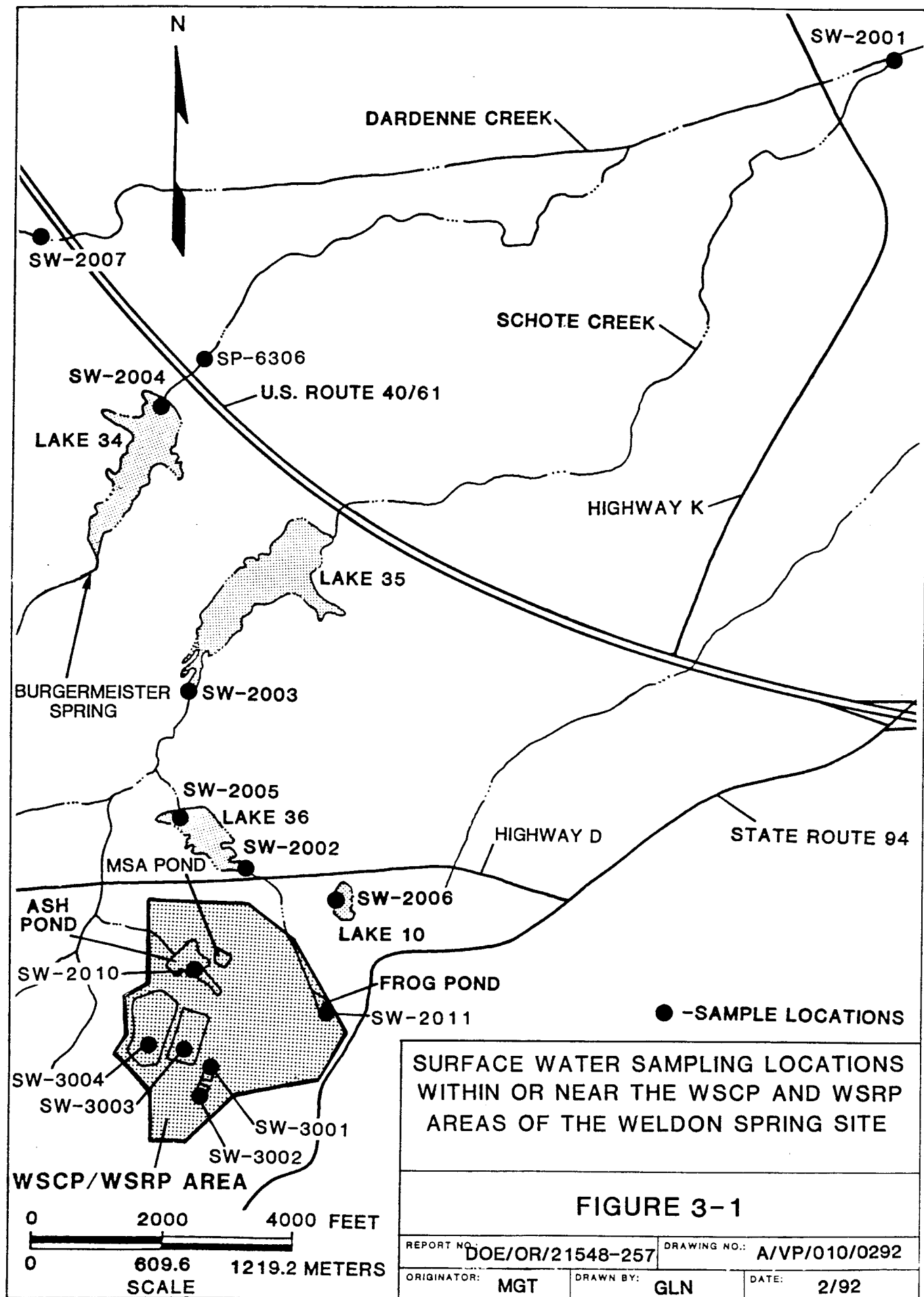
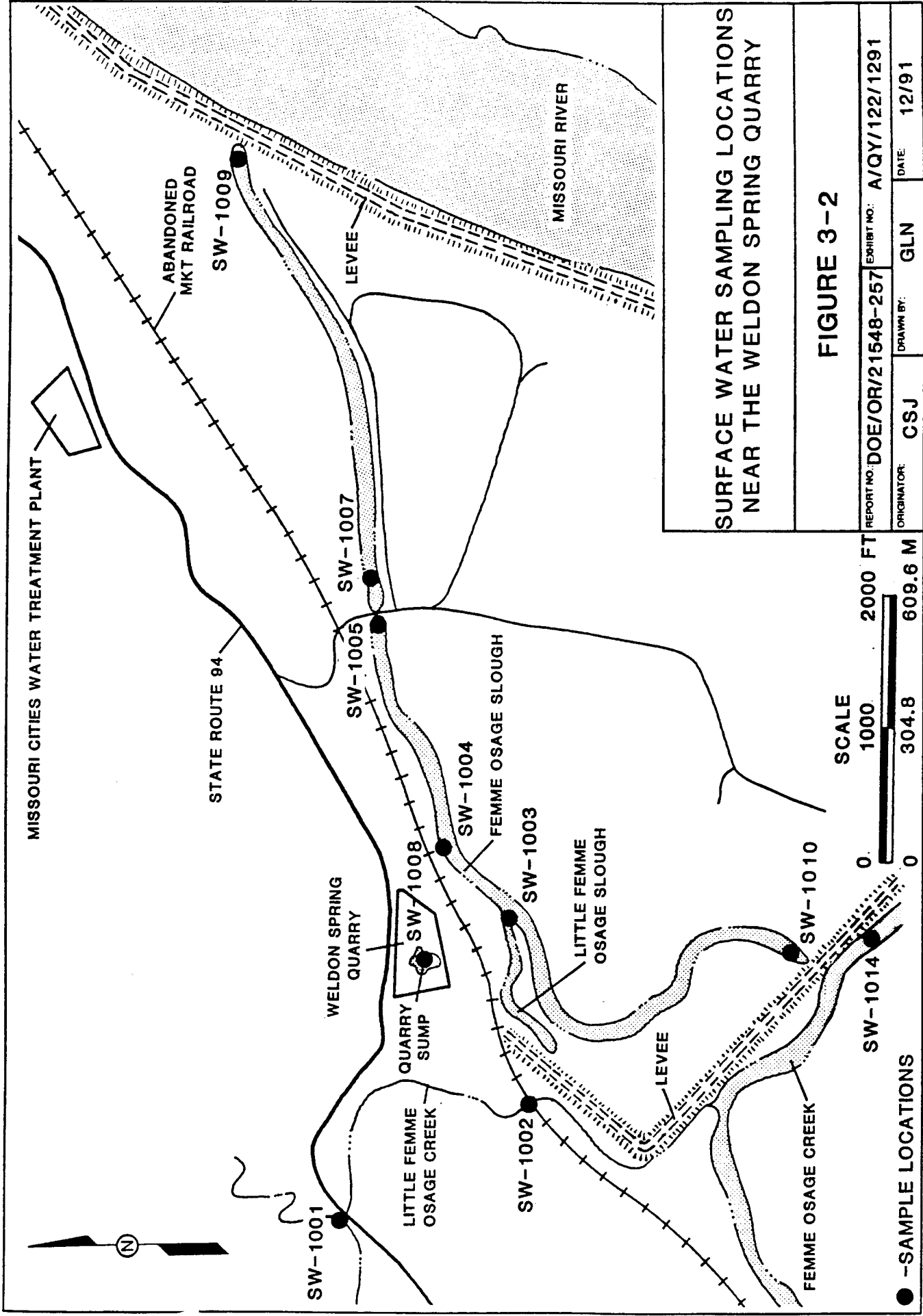


Table 3-1 Fourth Quarter Uranium Results in Surface Water at the WSCP/RP/VP

Sample ID	Uranium Total (pCi/l)
SW-2001-Q491	NA
SW-2002-Q491	NA
SW-2003-Q491	12.2
SW-2004-Q491	17.6
SW-2005-Q491	27.1
SW-2007-Q491	NA
SW-2010-Q491	NA
SW-2011-Q491	NA
SW-3001-Q491	72.1
SW-3002-Q491	1370
SW-3003-Q491	95.9
SW-3004-Q491	1750

ND Not Detected
NA Not Available



SURFACE WATER SAMPLING LOCATIONS NEAR THE WELDON SPRING QUARRY

FIGURE 3-2

REPORT NO: DOE/OR/21548-257	EXHIBIT NO: A/QY/122/1291
ORIGINATOR: CSJ	DRAWN BY: GLN
	DATE: 12/91

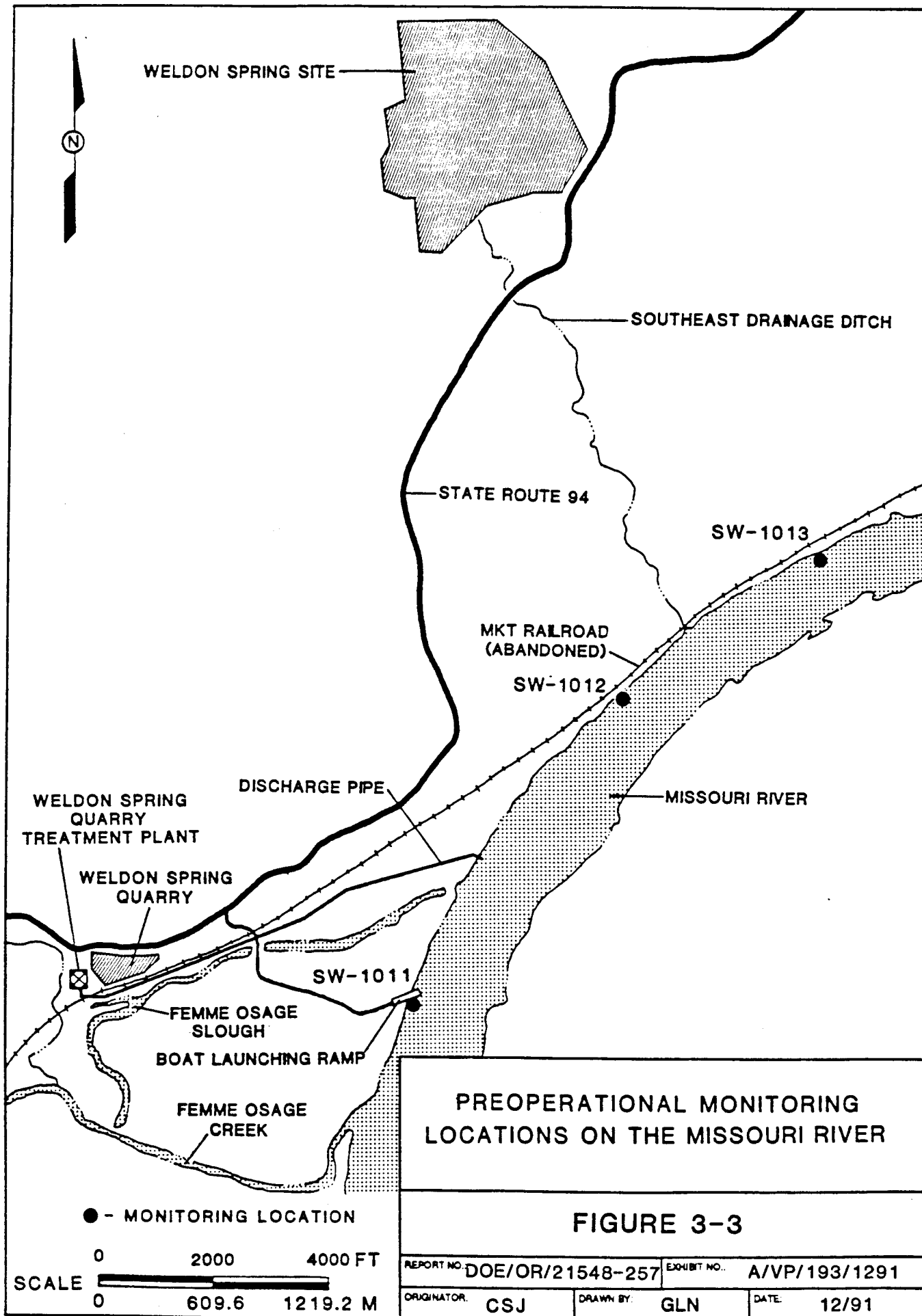


Table 3-2 Fourth Quarter Uranium Results in Surface Water at the Weldon Spring Quarry

Sample ID	Uranium, Total (pCi/l)
SW-1001-Q491	NA
SW-1002-Q491	2.05
SW-1003-Q491	34.0
SW-1003-101191	66.0
SW-1003-120291	65.1
SW-1004-Q491	40.1
SW-1004-101191	56.4
SW-1004-120291	66.9
SW-1005-Q491	8.65
SW-1005-101191	5.77
SW-1005-120291	8.02
SW-1007-Q491	13.1
SW-1007-101191	20.4
SW-1008-Q491	1950
SW-1009-Q491	13.0
SW-1009-101191	16.0
SW-1009-120291	10.2
SW-1010-Q491	33.4
SW-1010-101191	52.4
SW-1010-120291	22.2
SW-1011-121091	3.92
SW-1011-121391-FI	2.85
SW-1011-121391-NF	2.85
SW-1012-Q491	2.02
SW-1012-121391-F1	2.60
SW-1013-Q491	2.28
SW-1013-121391-F1	3.00
SW-1013-121391-NF	2.74

Table 3-2 Fourth Quarter Uranium Results in Surface Water at the Weldon Spring Quarry (Continued)

Sample ID	Uranium, Total (pCi/l)
SW-1014-0491	3.00
SW-1015-121391-F1	3.00
SW-1015-121391-NF	3.37

NA Not Available
FI Sample filtered
NF Sample not filtered

Table 3-3 Fourth Quarter Results for SW-1008

Parameter	Concentration	Units
1,3,5-TNB	0.32	$\mu\text{g/l}$
1,3-DNB	ND	$\mu\text{g/l}$
2,4,6-TNT	60.0	$\mu\text{g/l}$
2,4-DNT	11.0	$\mu\text{g/l}$
2,6-DNT	2.10	$\mu\text{g/l}$
Nitrobenzene	ND	$\mu\text{g/l}$
Nitrate	0.19	mg/l
Sulfate	79.9	mg/l
Radium-226	0.687	pCi/l
Thorium-230	3.82	pCi/l
Thorium-232	ND	pCi/l

ND Not detected

3.3 Springs

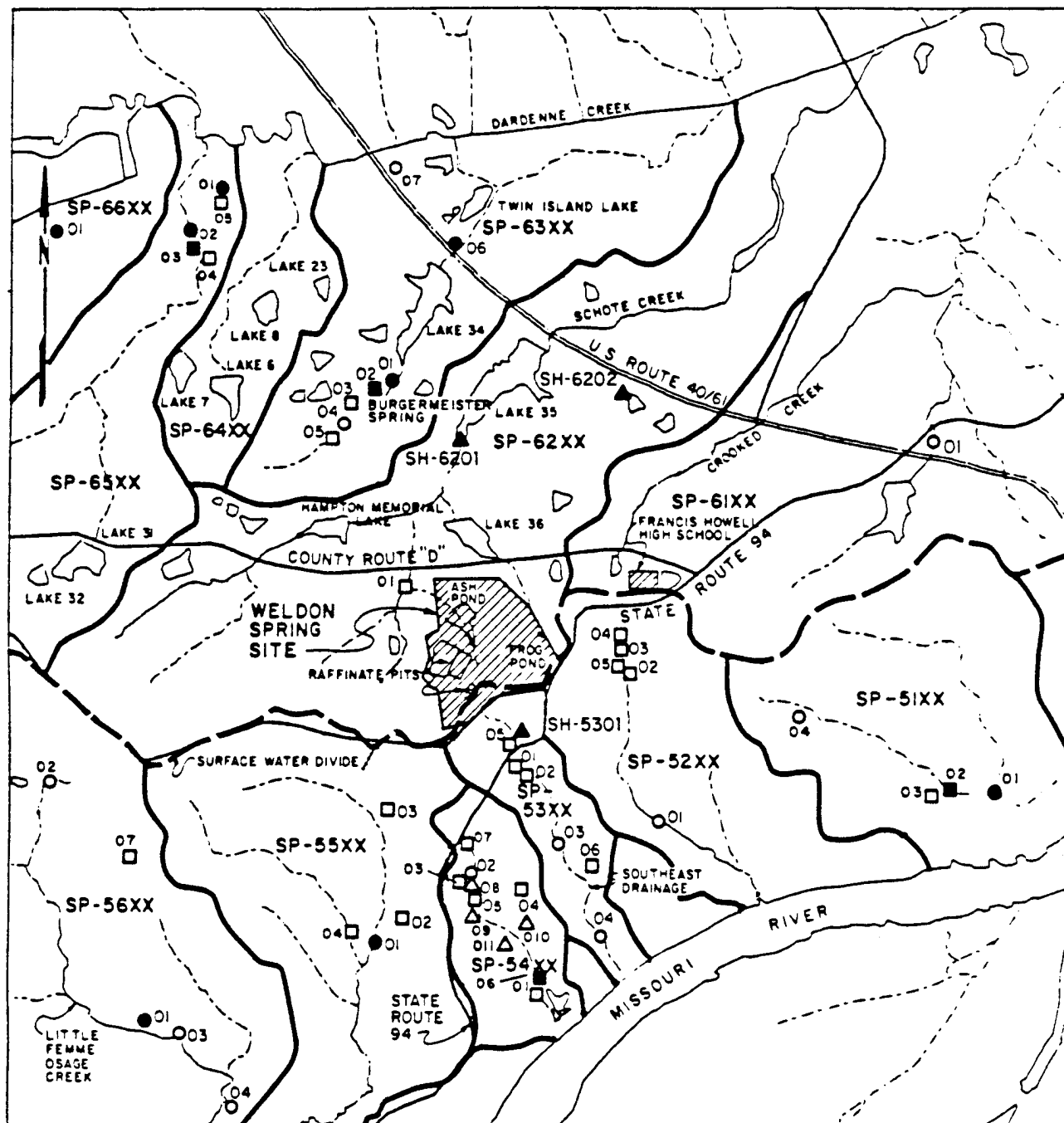
Nine springs around the Weldon Spring site (WSS) are sampled during fourth quarter (see Figure 3-4 for spring locations). Previous spring monitoring indicated that waters from six perennial springs and one wet-weather spring are measurably influenced by site-related contaminants. These springs include SP-5301 through SP-5304, SP-6301, SP-6302, and SP-6306. All spring samples are analyzed for uranium with a select few also analyzed for nitroaromatics, inorganics and metals. Available analytical results for these parameters are listed in Tables 3-4, 3-5, and 3-6. Values for these parameters remain consistent with historical values.

3.4 National Pollutant Discharge Elimination System Data Review

Surface water and effluent samples were collected and analyzed in compliance with the Weldon Spring site NPDES permits. Permit No. MO-0107701 was issued on October 1, 1990, and currently addresses the five storm water and two wastewater discharges shown in Figure 3-5. Outfalls NP-0001 through NP-0005 represent storm water discharges; Outfall NP-0006 represents the treated effluent discharge associated with the administration building sanitary wastewater treatment plant; and Outfall NP-0007 represents the site contaminated water treatment plant, which is under construction, but not yet completed. There was no discharge from NP-0007. Outfalls NP-0006 and NP-0007 have effluent limitations. The five storm water outfalls have monitoring requirements only. Fourth quarter 1991 analytical data for each outfall is presented in Table 3-6. Permit No. MO-0108987 was issued on May 5, 1989, for Outfall NP-1001 of the Weldon Spring Quarry contaminated water treatment plant. The plant construction is not completed, and no discharge took place during the fourth quarter of 1991.

3.4.1 Radiological Analysis

Gross alpha and total uranium analyses corresponded reasonably well with past data. The highest uranium levels were present in surface flow from Outfalls NP-0001, NP-0002, NP-0003, and NP-0005. The peaks for these points were 220 pCi/l, 332 pCi/l, 313 pCi/l, and 614 pCi/l, respectively. Outfall NP-0004 had a uranium concentration of 9.98 pCi/l from a single sample analysis. Although not required by the NPDES permit, the outfall from the administration building sanitary wastewater treatment plant (Outfall NP-0006) was also monitored for total uranium. No uranium was detected at this outfall.



LEGEND:

- SURFACE WATER DIVIDE BETWEEN MISSISSIPPI RIVER AND MISSOURI RIVER
- DRAINAGE BOUNDARY
- CREEK OR SURFACE DRAINAGE
- POND OR LAKE
- PERENNIAL SPRING WITH LARGE MAXIMUM FLOW
- PERENNIAL SPRING WITH SMALL MAXIMUM FLOW
- WET WEATHER SPRING WITH LARGE MAXIMUM FLOW
- WET WEATHER SPRING WITH SMALL MAXIMUM FLOW
- ▲ SHALLOW HOLE (SH)
- △ SEEP
- SPRING OR SEEP IN DESIGNATED DRAINAGE AREA NUMBER 63. XX REPRESENTS THE DESIGNATED SPRING NUMBER IN DRAINAGE 63.

SP-63XX

SCALE 0 3200 6400 FT
0 975.4 1950.7 M

SOURCE: MDNR, 1989

SPRINGS AND SEEPS IN THE VICINITY OF THE WSS

FIGURE 3-4

REPORT NO.: DOE/OR/21548-257	EXHIBIT NO.: A/VP/194/1291
ORIGINATOR: CSJ	DRAWN BY: GLN
DATE: 12/91	

Table 3-4 Fourth Quarter Uranium Results in Springs Near the Weldon Spring Site

Sample ID	Total Uranium (pCi/l)
SP-5203-Q491	NA
SP-5301-Q491	231
SP-5302-Q491	264
SP-5303-Q491	NA
SP-5304-Q491	NA
SP-6301-Q491	70.0
SP-6302-Q491	NA
SP-6303-Q491	2.51
SP-6306-Q491	NA

NA Not Available
ND Not Detected

Table 3-5 Fourth Quarter Nitroaromatic Results in Spring Near the Weldon Spring Site

Sample ID	1,3,5-TNB ($\mu\text{g/l}$)	1,3-DNB ($\mu\text{g/l}$)	2,4,6-TNT ($\mu\text{g/l}$)	2,4-DNT ($\mu\text{g/l}$)	2,6-DNT ($\mu\text{g/l}$)	NB ($\mu\text{g/l}$)
SP-6302	NA	NA	NA	NA	NA	NA
SP-6306-Q491	ND	ND	ND	ND	1.05	ND

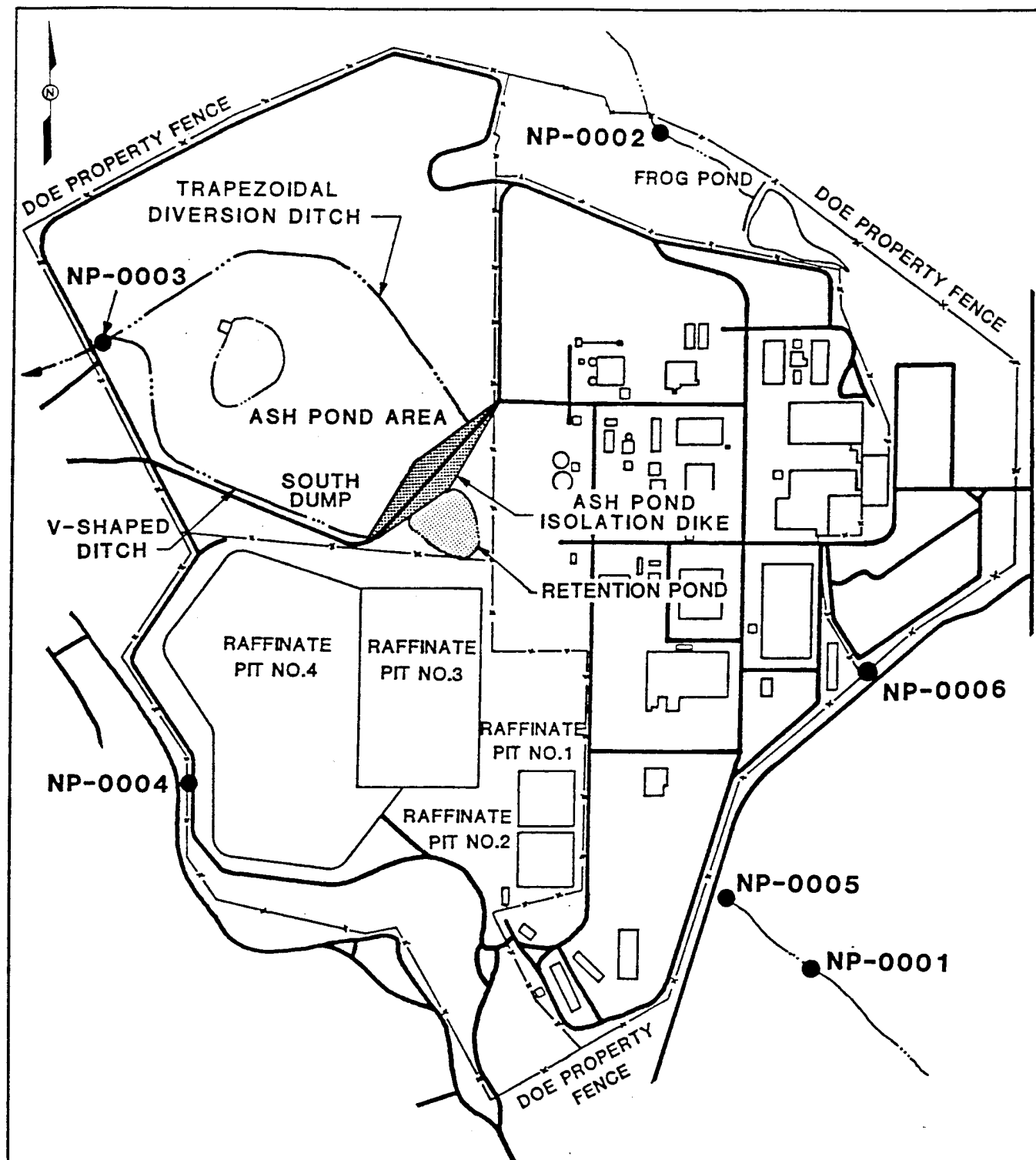
ND Not Detected

NA Not Available

Table 3-6 Fourth Quarter Metal Results for SP-6306

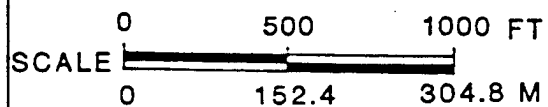
Parameters	Concentration ($\mu\text{g/l}$)
Aluminum	ND
Antimony	ND
Arsenic	4.90
Barium	324
Beryllium	ND
Cadmium	ND
Calcium	34400
Chromium	ND
Cobalt	ND
Copper	16.5
Iron	4470
Lead	2.00
Lithium	ND
Magnesium	8190
Manganese	7380
Mercury	ND
Molybdenum	ND
Nickel	11.1
Potassium	2970
Selenium	ND
Silver	ND
Sodium	9870
Thallium	ND
Vanadium	ND
Zinc	10.0

ND Not Detected



NPDES MONITORING LOCATIONS

FIGURE 3-5



REPORT NO.: DOE/OR/21548-257	EXHIBIT NO.: A/CP/276/1291
ORIGINATOR: CSJ	DRAWN BY: GLN
	DATE: 12/91

TABLE 3-7 Results of Monthly NPDES Monitoring for NP-0001 through NP-0006

Outfall NP-0001 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM	
UNITS	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
Oct. 24	5000	554	<0.1	0.64	8.0	ND	150	0.324	220

Outfall NP-0002 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM	
UNITS	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
Oct. 24	57,888	4	<0.1	ND	8.1	ND	49	.091	62
Nov. 14	2,448	6	<0.1	.25	6.4	ND	164	.362	246
Dec. 6	9,800	33	<0.1	1.2	6.0	ND	237	.488	332

Outfall NP-0003 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM	
UNITS	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
Oct. 2	163,152	5	<0.1	ND	6.4	ND	101	.025	17.2
Oct. 24	22,464	213	<0.1	ND	7.9	ND	92	.147	100
Nov. 14	10,656	11	<0.1	1.2	6.7	ND	193	.391	265
Nov. 27	21,600	--	<0.1	--	6.3	--	46	.079	54
Dec. 6	25,400	18	<0.1	17.5	6.1	ND	232	.460	313

TABLE 3-7 Results of Monthly NPDES Monitoring for NP-0001 through NP-0006 (Continued)

Outfall NP-0004 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM	
UNITS	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
Nov. 7	1440	451	--	1.7	7.1	ND	9.1	.015	9.98
Dec. 26	1440	--	<0.1	--	7.3	--	--	--	--

Outfall NP-0005 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM	
UNITS	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
Oct. 24	16,992	ND	0.3	1.27	8.0	ND	150	.236	160
Nov. 14	4,464	23	<0.1	3.2	7.0	ND	500	.903	614
Dec. 6	2,900	16	<0.1	21.2	6.1	ND	314	.498	339

Outfall NP-0006 NPDES data for Q4 1991

DATE SAMPLED	FLOW	SUSP. SOLIDS	BOD	FECAL COLIFORMS	pH
UNITS	GPD**	mg/l	mg/l	Colonies/100 ml	pH units
Oct. 4	1,440	13	--	--	5.8*
Oct. 7	2,340	11	<6.0	1	6.5
Nov. 13	2,700	11	13.9*	2,100*	6.7
Dec. 4	1,458	24*	<6.0	1	7.0
Dec. 18	--	10	--	--	6.6

* Indicates value which exceeded effluent limitation

** Indicates flow rate at time of sample collection

3.4.2 Other Analysis

Other analyses for NP-0001 through NP-0005 included physical analyses (settleable solids and total suspended solids) and chemical analyses (nitrate, pH, and lithium). Fourth quarter 1991 values generally correspond to past values for the majority of parameters. Four exceptions were high total suspended solids (TSS) values for Outfalls NP-0001, NP-0003, and NP-0004 and high settleable solids (SS) for Outfall NP-0005. The elevated values of TSS for outfalls NP-0001 and SS for NP-0005 were caused by surface water runoff from off-site water line construction activity and by excavation for the site water treatment plant. The elevated TSS at Outfall NP-0003 may have been due to the collection of floating debris; no other unusual circumstances were noted. The elevated value of TSS at NP-0004 may have been caused by stream bed disturbance during sample collection since very low flow in the shallow stream channel makes it difficult to collect a sample without stirring up small amounts of sediment.

The discharge from the administration building treatment plant, Outfall NP-0006, has effluent limitations and a requirement to monitor once per quarter. Flow must be measured once a month. The Subcontractor monitors the effluent once a month to assess plant performance, thus generating two additional sample analyses a quarter. The NPDES permit specifies effluent limitations for biochemical oxygen demand (BOD), total suspended solids (TSS), pH, and fecal coliform at this outfall. The limits for BOD are 10 mg/l monthly average and 15 mg/l weekly average; for TSS, 15 mg/l monthly average and 20 mg/l weekly average; for fecal coliform, 400 colonies per 100 ml monthly average and 1,000 colonies per 100 ml daily maximum. During the quarter, the effluent exceeded permitted limits four times; once for each of the four parameters. On November 13, 1991, BOD was 13.9 mg/l, which exceeded the monthly average limit of 10 mg/l; fecal coliform was 2,100 colonies/100 ml; which exceeded the daily maximum of 1,000 and the monthly average limit of 400 colonies/100 ml. On December 4, 1991, TSS was 24, which exceeded the weekly average limitation of 20 mg/l. An additional sample was collected on December 18, 1991, for TSS with a resultant value of 10 mg/l. The two samples average out to 17 mg/l, which is over the monthly average limit of 15. On October 4, 1991, pH was measured at 5.8 which is outside the permitted range of 6.0 to 9.0 (standard units). The Subcontractor added lime to the aeration compartment to increase the pH to above 6.0.

The Subcontractor will test the total residual chlorine of the effluent and inspect the chlorinator three times a week to ensure that the chlorine tablet supply is adequate. This should allow fecal coliform limits to be met. Sewage is delivered to the treatment plant by a lift station

causing an uneven flow which could cause high BOD, TSS, and fecal coliform levels. To foster a more consistent and effective treatment of the administration building wastewater, a flow equalization tank will be installed between the lift station and the sewage treatment plant. A request for specifications and an engineering proposal have been sent to an off-site A/E firm with oversight by our Engineering Department. The revised specifications for wastewater treatment facility services are under final review. The specifications will require the Subcontractor to sample the effluent during the first seven days of the calendar month and telephone or fax the results to the Project Management Contractor (PMC) as soon as they are available. The PMC will ensure that these requirements are met. This will allow time for additional sampling by the Subcontractor or the PMC if it is required.

A characterization sample was collected from Outfall NP-0006 on December 6, 1991. The sample was analyzed for the following parameters and the results are shown in parentheses: uranium-natural (ND), gross alpha (ND) and pH (5.3).

4 AIR MONITORING

4.1 Radon Gas

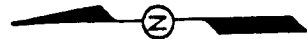
The radon gas monitoring program utilizes a pair of radon detectors at each of 22 permanent locations; each detector is exchanged quarterly. These detectors are deployed at six locations at the Weldon Spring Chemical Plant, six locations at the Weldon Spring Quarry, four locations at the Weldon Spring raffinate pits, and six off-site locations. Radon monitoring locations are shown in Figures 4-1, 4-2, and 4-3. On-site detectors are distributed around the perimeter fences to ensure adequate detection of radon dispersing from the properties under various atmospheric conditions. Locations RD-4001, RD-4004, RD-4005, and RD-4006 were used to monitor background levels near the site.

Table 4-1 summarizes the fourth quarter 1991 radon concentrations detected at all site perimeter and off-site monitoring locations. Also contained in Table 4-1 is a comparison of the measured concentration with the Federally permitted radon concentration (for unrestricted areas) of 3 pCi/l (110 Bq/m³) above background as authorized by U.S. Department of Energy (DOE) Order 5400.5.

An average ambient background concentration was determined by calculating the arithmetic average for the four background locations. This data yielded an average ambient background radon concentration of 0.2 pCi/l for the fourth quarter of 1991. This concentration was then subtracted from the concentration for each monitoring station, and compared to the DOE guideline of 3 pCi/l above background.

Radon concentrations at the site and quarry perimeters and at off-site locations for the fourth quarter of 1991 were within the typical range expected during periods of normal precipitation as was the condition for this period. The quarterly radon concentrations (background included) ranged from 0.1 pCi/l at four monitoring locations to 1.8 pCi/l at monitoring location RD-1002.

Radon concentrations found in the quarry are higher than concentrations measured at other locations because the radium concentrations in quarry wastes are typically much higher than other areas, and because the quarry is a large depression with side walls ranging from 3 m to 15 m (10 ft to 50 ft) high. In conjunction with stable meteorological conditions,



AUGUST A. BUSCH MEMORIAL WILDLIFE AREA

LAKE 36

BUSCH WILDLIFE AREA
HEADQUARTERS

RD-4001
TD-4001

RD-2001
TD-2001

RD-3001
TD-3001

AP-3003

RD-3004
TD-3002

U.S. ARMY RESERVE
TRAINING AREA

ASHPOND

W.S.H.P.

W.S.C.P.

AP-2002

RD-2002
TD-2002

RD-2003
TD-2003

RD-2004
TD-2004

RD-2005
TD-2005

RD-2006
TD-2006

RD-2007
TD-2007

RD-2008
TD-2008

RD-2009
TD-2009

RD-2010
TD-2010

RD-2011
TD-2011

RD-2012
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RD-2013
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RD-2015
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RD-2016
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RD-2017
TD-2017

RD-2018
TD-2018

RD-2019
TD-2019

RD-2020
TD-2020

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HIGHWAY D

UNIV. OF MISSOURI
RESEARCH CENTER

FRANCIS HOWELL
HIGH SCHOOL

RD-4003
TD-4003

RD-4004
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RD-4006
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RD-4007
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RD-4008
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RD-4035
TD-4035

- ▲ AIR PARTICULATE MONITORING LOCATION
- RADON-222 & T.L.D. MONITORING LOCATION

0 1000 2000 SCALE

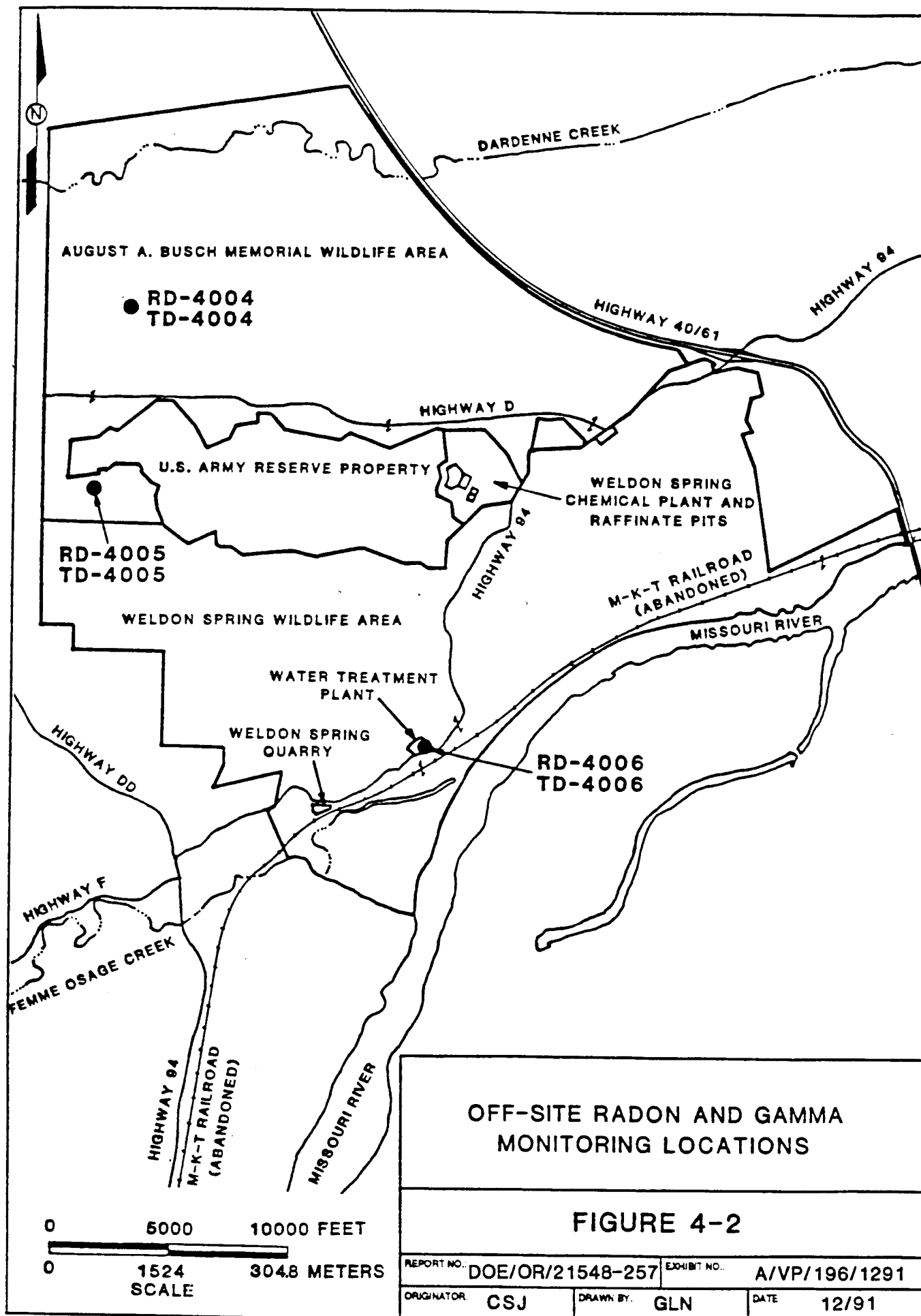
0 304.8 609.6 METERS

SCALE

RADON-222, TLD, AND AIR PARTICULATE MEASUREMENT LOCATIONS AT THE WSCP/WSRP AREA

FIGURE 4-1

REPORT NO	DOE/OR/21548-257	EXHIBIT NO:	A/VP/195/1291
ORIGINATOR	CSJ	DRAWN BY:	GLN
		DATE	12/91



OFF-SITE RADON AND GAMMA MONITORING LOCATIONS

FIGURE 4-2

REPORT NO.	DOE/OR/21548-257	EXHIBIT NO.	A/VP/196/1291
ORIGINATOR	CSJ	DRAWN BY	GLN
		DATE	12/91

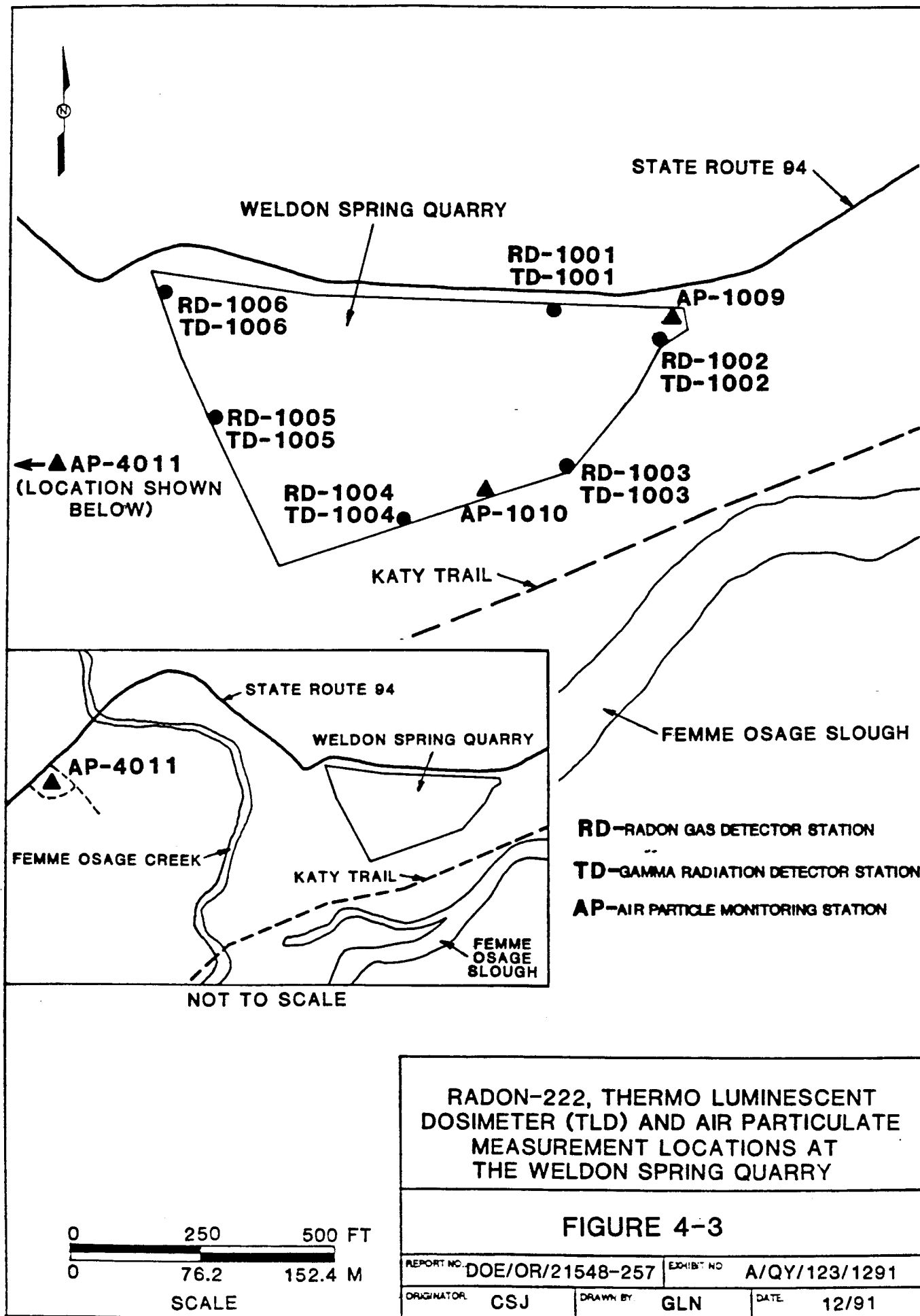


TABLE 4-1 1991 Track Etch Radon Results^(a)

LOCATION ID	4TH QUARTER pCi/l	PERCENT OF GUIDANCE ^(b)
WSQ		
RD-1001	1.1	30
RD-1002	1.8	53
RD-1003	0.8	20
RD-1004	0.4	7
RD-1005	0.6	13
RD-1006	0.2	0
WSCP		
RD-2001	0.3	3
RD-2002	0.2	0
RD-2003	0.1	0
RD-2004	0.2	0
RD-2005	0.1	0
RD-2006	0.3	0
WSRP		
RD-3001	0.3	3
RD-3002	0.2	0
RD-3003	0.2	0
RD-3004	0.1	0
OFF-SITE		
RD-4001 *	0.2	0
RD-4002	0.2	0
RD-4003	0.2	0
RD-4004 *	0.2	0
RD-4005 *	0.1	0
RD-4006 *	0.2	0

(a) Results include natural background.

(b) Percent of guideline calculated by taking the quarterly average minus the average of the background stations divided by the DOE concentration guideline for RN-222 which is 3 pCi/l (110 Bq/m³)(Annual average above background) for uncontrolled areas.

* Denotes Background Station

this configuration tends to trap emanating radon within the quarry and raise the concentrations along the quarry perimeter.

4.2 Gamma Radiation Exposure

To monitor exposure from gamma radiation, spherical environmental thermoluminescent dosimeters (TLDs) were deployed at 22 locations. The gamma monitoring station locations are the same as the ambient radon monitoring locations (see Section 4.1).

Table 4-2 summarizes the first, second, and third quarter results of total gamma radiation monitoring at the 16 Weldon Spring site (WSS) perimeter monitoring stations, the Francis Howell High School, the Weldon Spring Army Reserve Training Area, and at the four background monitoring stations.

The annual average background gamma exposures measured with TLDs in 1989 and 1990 were 68 mR/year and 62 mR/year, respectively. The gamma exposures measured with TLDs in the first, second, and third quarter of 1991 were consistent with 1989 and 1990 data. This was expected because no significant changes in the configuration or location of the wastes have occurred.

The fourth quarter data was not available when this document was drafted. The data will be available upon request and will be included in the 1991 *Annual Site Environmental Report*.

4.3 Radioactive Air Particulates

Eleven low volume air particulate samplers monitor the Weldon Spring site continuously. Five of these (AP-2001, AP-2002, AP-3003, AP-3004, and AP-2005) are located around the Weldon Spring Chemical Plant (WSCP) perimeter and two are located around the quarry perimeter as shown in Figure 4-3. Three monitoring stations (AP-4006, AP-4008, and AP-4011) are located off site at sensitive receptor locations; including Francis Howell High School; the Army Reserve property; and near a residential site west of the quarry. The monitoring station at the August A. Busch Wildlife Area (AP-4007) is used to monitor background levels in the vicinity of the WSCP. The off-site monitoring stations are also shown in Figure 4-2.

TABLE 4-2 1991 Environmental TLD Results^(a)

Location ID	1st Quarter mrem	2nd Quarter mrem	3rd Quarter mrem	4th Quarter mrem
WSQ				
TD-1001	24	17	21	NA
TD-1002	20	15	17	NA
TD-1003	20	20	19	NA
TD-1004	19	17	18	NA
TD-1005	20	17	18	NA
TD-1006	19	18	17	NA
WSCP				
TD-2001	18	16	15	NA
TD-2002	17	16	17	NA
TD-2003	18	17	16	NA
TD-2004	19	17	17	NA
TD-2005	18	14	15	NA
TD-2006	17	15	16	NA
WSRP				
TD-3001	22	14	15	NA
TD-3002	17	13	13	NA
TD-3003	19	17	16	NA
TD-3004	16	14	16	NA
OFF-SITE				
TD-4001 [*]	18	16	---	NA
TD-4002	16	13	14	NA
TD-4003	16	12	12	NA
TD-4004 [*]	19	--	16	NA
TD-4005 [*]	16	13	12	NA
TD-4006 [*]	17	15	17	NA

(a) Results include natural background.

- Denotes loss of TLD.

* Denotes background station.

NA Not Available

TABLE 4-3 Radiological Air Particulate Fourth Quarter 1991

MONITOR IDENTIFICATION NUMBER	QUARTERLY AVG. CONCENTRATION ($\mu\text{Ci/ml}$)	STANDARD DEVIATION ($\mu\text{Ci/ml}$)	NUMBER OF WEEKS COLLECTED	NUMBER OF VALUES ABOVE LLD
AP-2001	<1.47E-15	5.38E-16	13	11
AP-2002	<1.78E-15	6.69E-16	13	12
AP-3003	<1.64E-15	7.18E-16	13	11
AP-3004	<1.57E-15	7.05E-16	12	11
AP-2005	1.57E-15	6.75E-16	13	13
AP-4006	<1.74E-15	6.82E-16	13	11
AP-4007*	1.64E-15	5.91E-16	12	12
AP-4008	1.77E-15	7.40E-16	13	13
AP-1009	1.81E-15	7.95E-16	12	12
AP1010	<1.77E-15	7.23E-16	13	12
AP-4011	1.75E-15	8.16E-16	13	13

* Indicates background monitor station.
 To convert $\mu\text{Ci/ml}$ to Bq/M^3 , multiply by $3.7\text{E}10$.
 NA Not available

The sampling station near the August A. Busch Wildlife Area (ABWA) headquarters is used as a background air monitoring station. This station is approximately 0.8 km (0.5 mile) from the WSCP perimeter in a northwestern direction. The terrain between the WSCP and this sampling station is hilly and forested, providing a significant physical barrier to airborne particulates originating from the WSCP/Weldon Spring raffinate pits (WSRP).

Table 4-3 summarizes the quarterly average concentrations and the standard deviations for the 11 air monitoring locations. The quarterly average concentration for each monitoring location was calculated by averaging either the weekly air particulate analysis results or the counting instrument's lower limit of detection (LLD), whichever was greater. The "<" sign in Table 4-3 appears when the actual average is less than the calculated average due to the use of LLD values in the calculation. The standard deviation for each of the monitoring locations was calculated using only results that were above the LLD. Due to maintenance, all monitors were not operating the entire 13 weeks as indicated in Table 4-3. However, the sensitive receptor monitoring stations (AP-4006, AP-4008, and AP-4011) were in operation the entire quarter and these stations are also equipped with high volume air monitoring. The high volume air monitors are part of the WSS radionuclide National Emissions Standards for Hazardous Air Pollutants (NESHAPs) requirements and were in operation the fourth quarter. The high volume monitoring results will be presented in the *Annual Site Environmental Report*.

The fourth quarter net alpha concentrations ranged from $<1.47 \times 10^{-15} \mu\text{Ci/ml}$ to $<1.81 \times 10^{-15} \mu\text{Ci/ml}$ with $1.64 \times 10^{-15} \mu\text{Ci/ml}$ detected at the background station.

4.4 Asbestos

No environmental asbestos monitoring was performed in the fourth quarter of 1991.

5 REFERENCES

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MK-Ferguson Company and Jacobs Engineering Group, 1991. *Environmental Monitoring Plan*. Rev. 0. DOE/OR/21548-237. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, Missouri. November.

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